VOLUME 51 SECOND SERIES

CONTENTS

JANUARY 1, 1937

Beta-Ray Spectra of Radium E and Radioactive Phosphorus . . . . . ERNEST M. LYMAN 1
Alpha-Particle Bombardment of Neon, Calcium and Argon and Masses of Light Nuclei . . . . . ERNEST POLLARD AND CHARLES J. BRASEFIELD 8
Vibrational Analysis of the Emission Bands of Germanous Oxide . . . . R. WILLIAM SHAW 12
Helium I Like Spectra . . . . . HOWARD A. ROBINSON 14
Nuclear Spin and Magnetic Moment of Li^6 . . . . . J. H. MANLEY AND S. MILLMAN 19
Magnetic Scattering of Slow Neutrons . . . . . L. JACKSON LASLETT 22
On the Cross Sections of Cl_2 and N_2 for Slow Electrons . . . . . J. B. FISK 25
Probe Measurements on High Pressure Arcs . . . . . R. C. MASON 28
Polymorphism of Rochelle Salt . . . . . HANS VON R. JAFFE 43

Letters to the Editor:

Pressure Broadening in Bands of Dipole Molecules . . . . W. W. WATSON AND H. MARGENAU 48
Gamma-Radiation from Lithium Bombarded with Protons . E. R. GAERTTNER AND H. R. CRANE 49
Is the Momentum a Sufficient Description of a Photon or an Electron? . . . . H. R. CRANE 50
Quantum Theory of the Second Virial Coefficient . . . . . LEON GROPPER 50
Experiments on the Magnetic Properties of the Neutron . . . . . J. R. DUNNING, P. N. POWERS AND H. G. BEYER 51
Intermediate Nucleus and Atomic Disintegration in Steps . . . . . W. D. HARKINS 52
Rotation-Vibration Spectrum of C_2H_6 and the Question of Internal Rotation . . . J. B. HOWARD 53
Elastic Scattering of Neutrons by Protons . . . . . J. B. FISK AND PHILIP M. MORSE 54
Self-Consistent Field and Bohr's Nuclear Model . . . . . W. M. ELSASSER 55
Current Difference in Gamma-Ray Ionization Measurements . . . . . EVERETT F. COX 55
Correction: Photoelectric Effect of the Deuteron . . . G. BREIT, E. U. CONDON AND J. R. STEHN 56

Proceedings of the American Physical Society:

CHICAGO MEETING, November 27–28, 1936; Minutes and Abstracts 1–41 57

JANUARY 15, 1937

Electric and Magnetic Focusing in Mass Spectroscopy . . . . . A. J. DEMPSTER 67
Electron and Negative Ion Mobilities in Oxygen, Air, Nitrous Oxide and Ammonia . . . . . RUSSELL A. NIELSEN AND NORRIS E. BRADBURY 69
Development and Performance of an Electrostatic Generator Operating Under High Air Pressure . . . . . R. G. HERB, D. B. PARKINSON AND D. W. KERST 75
On the Capture of Orbital Electrons by Nuclei . . . . . C. MØLLER 84
Study of Kinetic Energies of Atomic Ions Formed by Electron Impact in Nitric Oxide and Hydrogen Chloride . . . . . ELMO E. HANSON 86
On the Structure of the Nuclei Between Helium and Oxygen . . E. FEENBERG AND E. WIGNER 95
On the Consequences of the Symmetry of the Nuclear Hamiltonian on the Spectroscopy of Nuclei . . . . . E. WIGNER 106
Absolute Photoelectric Yields of Mg, Be and Na . . . . . MARVIN W. MANN, JR. AND LEE A. DUBRIDGE 120
Symmetry Theorem in the Positron Theory . . . . . W. H. FURRY 125
Energy Bands for the Face-Centered Lattice . . . . . WILLIAM SHOCKLEY 129
Ferromagnetic Anisotropy in Nickel-Cobalt-Iron Crystals at Various Temperatures . . . . . L. W. MCKEEHAN 136

Letters to the Editor:

Emission of Neutrons from Chlorine and Argon Under Alpha-Particle Bombardment . . . . . ERNEST POLLARD, H. L. SCHULTZ AND GORDON BRUBAKER 140
Scattering of Electrons by Atomic Nuclei . . . . . R. T. COX AND C. T. CHASE 140
Explanation of the Relative Stabilities of Isotopes of the Lighter Elements . WENDELL M. LATIMER 141
Erratum: Investigations of the Deuteron-Deuteron Reaction . R. LADENBURG AND R. B. ROBERTS 141

Proceedings of the American Physical Society:

PASADENA MEETING, December 18 and 19, 1936; Minutes and Abstracts, 1–35 142

FEBRUARY 1, 1937

Intensities of X-Ray Reflections from Bismuth Crystals Between 25° and 530° Abs. . . . . ALEXANDER GOETZ AND ROBERT B. JACOBS 151
Thermal Expansion of the Bi Lattice Between 25° and 530° Abs. . . . . ROBERT B. JACOBS AND ALEXANDER GOETZ 159
Index of Refraction of Cerussite for X-Rays . . . J. E. FIELD AND GEORGE A. LINDSAY 165
Radiations Emitted from Artifically Produced Radioactive Substances. III. Details of the Beta-Ray Spectrum of P^{32} . . . . . HUGH C. PAXTON 170
Radioactive Isotope of Potassium . . . . . W. R. SMYTHE AND A. HEMMENDINGER 178
Disintegration of Beryllium by Protons. . . . . J. S. ALLEN 182
Note on the Capture of Slow Neutrons in Hydrogenous Substances . WILLIS E. LAMB, JR. 187
Effect of Nuclear Motion in the Dirac Equation . . . . . IRVING S. LOWEN 190
Nature of the Superconducting State . . . . . J. C. SLATER 195
Approximation to Discrete Quantum States by Iteration. . . . . L. H. THOMAS 202
Nuclear Spins and Magnetic Moments in the Hartree Model. M. E. ROSE AND H. A. BETHE 205
Some Direct Evidence on the Magnetic Moment of the Neutron . . . . . J. G. HOFFMAN, M. STANLEY LIVINGSTON AND H. A. BETHE 214

Letters to the Editor:

An Explanation for Directions of Easy Magnetization in Ferromagnetic Cubic Crystals . . . . . R. M. BOZORTH AND L. W. MCKEEHAN 216

FEBRUARY 15, 1937

Nature of the Soft Component of the Cosmic Radiation. . . . . C. G. MONTGOMERY AND D. D. MONTGOMERY 217
On Multiplicative Showers . . . . . J. F. CARLSON AND J. R. OPPENHEIMER 220
Ionization of Air by γ-Rays as a Function of Pressure and Collecting Field II . . . . . I. S. BOWEN AND EVERETT F. COX 232
Depolarization of Raman Lines and Structure of Chlorate, Bromate and Iodate Ions . . . . . S. T. SHEN, Y. T. YAO AND TA-YOU WU 235
$^1\Sigma^* - {}^1\Sigma$ Band System of Ionized Cadmium Deuteride . . . . . R. V. ZUMSTEIN, J. W. GABEL AND R. E. MCKAY 238
Interferometer Wave-Lengths of Certain Lines in the Secondary Spectrum of D_2 and HD. . . . . NORTON A. KENT AND REGINALD G. LACOUNT 241
Zeeman Effect of N II . . . . . J. B. GREEN AND H. N. MAXWELL 243
Refractive Index of Water for Electromagnetic Waves Eight to Twenty-Four Centimeters in Length . . . . . THOMAS T. GOLDSMITH, JR. 245
Approximately Relativistic Equations for Nuclear Particles . . . . . G. BREIT 248
Ionization and Dissociation of Polyatomic Molecules by Electron Impact. I. Methane . . . . . LINCOLN G. SMITH 263
Thermionic Emission into Dielectric Liquids . . EDWARD B. BAKER AND HOWARD A. BOLTZ 275
Kinetic Energy of Nuclei in the Hartree Model . . . . . H. A. BETHE AND M. E. ROSE 283
Spherical Symmetry of Self-Consistent Atomic Fields . . . . . A. F. STEVENSON 285

Letters to the Editor:

On the Anomalous Diffraction Gratings. II . . . . . UGO FANO 288
Infrared Absorption of the Hydrogen Halides in Organic Solvents . . . . DUDLEY WILLIAMS 288
Some Generalizations of the β Transformation Theory . . . . . G. GAMOW AND E. TELLER 289
Isotopic Constitution of Neodymium . . . . . A. J. DEMPSTER 289
Nebulae as Gravitational Lenses . . . . . F. ZWICKY 290
Emergence of Low Energy Protons from Nuclei . . . . . ERNEST POLLARD 290
Cyclotron Operation Without Filaments . P. GERALD KRUGER, G. K. GREEN AND F W. STALLMANN 291
Asymmetric Zeeman Effect Patterns in a Complex Spectrum . . . J. E. MACK AND O. LAPORTE 291

MARCH 1, 1937

Absorption of Ionic Crystals in the Ultraviolet . . E. G. SCHNEIDER AND H. M. O'BRYAN 293
Modification of Spectral Lines by Very Close Collisions . . . . WILLIAM M. PRESTON 298
Spectroscopic Study of the Magnetron Discharge . . OVERTON LUHR AND FRANK J. STUDER 306
Low Electronic States of Simple Heteropolar Diatomic Molecules: III. Hydrogen and Univalent Metal Halides . . . . . ROBERT S. MULLIKEN 310
Heights of Reflection of Radio Waves in the Ionosphere . F. H. MURRAY AND J. BARTON HOAG 333
Fine Structure in the $^3\Sigma$ Ground State of the Oxygen Molecule, and the Rotational Intensity Distribution in the Atmospheric Oxygen Band . . . . . ROBERT SCHLAPP 342
Photoelectric Work Functions of the 211 and 310 Planes of Tungsten . . . . . C. E. MENDENHALL AND CHARLES F. DEVOE 346
On the Calculation of Errors . . . . . LLOYD T. DEVORE 349
Resistance of Monovalent Metals . . . . . E. L. PETERSON AND L. W. NORDHEIM 355
Dependence of Luminescence on Physical Structure in Zinc Borate Compounds . . . . . D. H. KABAKJIAN 365

Letters to the Editor:

Refraction of Neutrons . . . . . GILBERT N. LEWIS AND PHILIP W. SCHUTZ 369
On the Interaction of Fast Neutrons with Lead . . . . . G. E. GIBSON, G. T. SEABORG AND D. C. GRAHAME 370
Virial Theorem in Nuclear Problems . . . . . E. L. HILL 370
Neutron Optics . . . . . GILBERT N. LEWIS 371
Experiments on the Magnetic Moment of the Neutron . . . . . P. N. POWERS, H. G. BEYER AND J. R. DUNNING 371

Proceedings of the American Physical Society:

ATLANTIC CITY MEETING, December 28–30, 1936; Minutes and Abstracts 1–65; Author Index 373

MARCH 15, 1937

Geiger-Müller Counter Measurements of Cosmic-Ray Intensities in the Stratosphere . . . . . W. F. G. SWANN, G. L. LOCHER AND W. E. DANFORTH 389
Energy and Absorption of the Gamma-Radiation from Li^7+H^1 . . . . . L. A. DELSASSO, W. A. FOWLER AND C. C. LAURITSEN 391
Determination of h/e from the Short Wave-Length Limit of the Continuous X-Ray Spectrum . . . . . JESSE DUMOND AND VERNON BOLLMAN 400
Infrared Absorption of Dilute Solutions of HCl and HBr . . . . . C. E. LEBERKNIGHT AND JOHN A. ORD 430
Resonance Process in the Disintegration of Boron by Protons . . . . . J. H. WILLIAMS, W. H. WELLS, J. T. TATE AND E. L. HILL 434
Induced Radioactivity of Calcium . . . . . HAROLD WALKE 439
New Method of Analysis of the Structure of Hα and Dα . . . . . W. V. HOUSTON 446
Resonance Effects in Nuclear Processes . . . . . H. A. BETHE AND G. PLACZEK 450
Relativistic Wave Functions in the Continuous Spectrum for the Coulomb Field . . . . . MORRIS E. ROSE 484
Band Spectra of SbF and BiF . . . . . GEORGE D. ROCHESTER 486
Spectra of Neutral and Ionized Boron Hydride . . G. M. ALMY AND R. B. HORSFALL, JR. 491
Sign of the Magnetic Moment of the K^{39} Nucleus . . . . . HENRY CUTLER TORREY 501
Effect of CCl_4 Vapor on the Dielectric Strength of Air . . M. T. RODINE AND R. G. HERB 508
Quantum Equations in Cosmological Spaces . . . . . A. H. TAUB 512
Stable Isobars . . . . . D. R. INGLIS AND L. A. YOUNG 525

Letters to the Editor:

Gamma-Radiation from Fluorine Bombarded with Protons . . . . . L. A. DELSASSO, W. A. FOWLER AND C. C. LAURITSEN 527
On the Ionization of Gases by High Energy Beta-Particles . . . . . F. T. ROGERS, JR. 528
Magnetic Anisotropy of $Cs_2[CoCl_4]$ . . . . . K. S. KRISHNAN AND ASUTOSH MOOKHERJI 528
Quantum Limit of the Continuous Spectrum . . . . . PAUL KIRKPATRICK AND P. A. ROSS 529
Raman Effect of Gaseous Methyl- and Dimethylacetylenes . GEORGE GLOCKLER AND F. T. WALL 529
Reemission of Visible Light and the Coloration by Ultraviolet Light of Certain Crystals . . . . . JAMES H. HIBBEN 530

APRIL 1, 1937

Perturbation Theory of Light Nuclei: He^4 and Li^6 . . . D. R. INGLIS 531
On the Magnetic Scattering of Neutrons . . . J. S. SCHWINGER 544
Photoelectric Cross Section of the Deuteron . . . KATHARINE WAY 552
Unidirectional Measurements of the Cosmic-Ray Latitude Effect . . . THOMAS H. JOHNSON AND DONALD N. READ 557
Effects of Certain Liquids on the OH Vibrational Band of Alcohol . . . WALTER GORDY 564
Displacement of Principal Series Lines of Rubidium by the Addition of Rare Gases . . . NY TSI-ZÉ AND CH'EN SHANG-YI 567
Temperature Shift of the Potassium Resonance Lines . . . GORDON F. HULL, JR. 572
On the Behavior of a Certain Supraconducting Circuit . . . RICHARD J. DUFFIN 575
Note on the Hartree and Hartree-Fock Methods . . . N. H. FRANK 577
Note on the Search for Element 87 . . . F. R. HIRSH, JR. 584
Note on the Density of Eigenfunctions for an Electron Obeying Dirac's Equation . . . E. K. BROCH 586
Erratum: The Precise Measurement of Three Radium B Beta-Particle Energies . . . F. T. ROGERS, JR. 588

Letters to the Editor:

Concerning the Probable Magnitude of the Next Sunspot Maximum . . . A. L. DURKEE 589
Correction Due to Motion of Center of Gravity in the Hartree Approximation in Nuclei . . . A. F. STEVENSON 590
Inelastic Scattering of Fast Neutrons . . . D. C. GRAHAME, G. T. SEABORG AND G. E. GIBSON 590
Potential and Luminescence Insulated Willemite of Cathode-Ray Screens . . . W. B. NOTTINGHAM 591
Application of the Theory of Neutron Absorption in Aqueous Solutions . . . W. H. FURRY 592
Theory of Elasticity . . . F. D. MURNAGHAN 593
Disintegration of Li^8 . . . G. BREIT AND E. WIGNER 593
Common Ion Effect in Some Aqueous Solutions as Shown by Means of the Raman Effect . . . JAMES H. HIBBEN 593

Proceedings of the American Physical Society:

NEW ENGLAND SECTION, Cambridge Meeting, February 6, 1937; Minutes and Abstracts 1–12 594
METROPOLITAN SECTION, March 12, 1937 . . . 596

APRIL 15, 1937

On the Structure of Light Nuclei . . . E. FEENBERG AND M. PHILLIPS 597
Disintegration of Cadmium with Deuterons . . . J. M. CORK AND R. L. THORNTON 608
Relations Between the Second and Higher Order Processes in the Neutrino-Electron Field Theory . . . M. H. JOHNSON, JR. AND H. PRIMAKOFF 612
Transmutation Functions at High Bombarding Energies . . . HENRY W. NEWSON 620
Radioactivity Induced in Silicon and Phosphorus by Deuteron Bombardment . . . HENRY W. NEWSON 624
Secondary Particles from the Penetrating Component of the Cosmic Radiation . . . WILLIAM H. PICKERING 628
Structure of the X-Ray *K* Absorption Limits of Bromine, Iodine, and Some of Their Compounds . . . BERNARD CIOFFARI 630
X-Ray Fluorescence Yields . . . R. J. STEPHENSON 637
Energy Distribution of Photoelectrons Emitted by Calcium and Calcium Oxide . ISRAEL LIBEN 642
On Nonadiabatic Processes in Inhomogeneous Fields . . . JULIAN SCHWINGER 648
Space Quantization in a Gyrating Magnetic Field . . . I. I. RABI 652
Helium Wave Equation . . . T. H. GRONWALL 655
Helium Wave Equation . . . J. H. BARTLETT, JR. 661
On the Connection Formulas and the Solutions of the Wave Equation . RUDOLPH E. LANGER 669

Letters to the Editor:

Note on the Mathematical Foundation of the Thermodynamical Equation of State . WITOLD JACYNA 677
On the Nuclear Transformation with the Absorption of the Orbital Electron . . . HIDEKI YUKAWA AND SHOICHI SAKATA 677
On the Nature of the Superconducting State . . . F. LONDON 678
On the Probability of Detecting Nebulae Which Act as Gravitational Lenses . . . F. ZWICKY 679
Electric Breakdown Field Intensity of Water and Aqueous Solutions . . . Y. TORIYAMA AND U. SHINOHARA 680

Proceedings of the American Physical Society:

NORTH CAROLINA MEETING, February 19–20, 1937; Minutes and Abstracts 1–47; Author Index 681

MAY 1, 1937

Gamma-Rays from Light Elements Due to Proton Bombardment . . . R. G. HERB, D. W. KERST AND J. L. MCKIBBEN 691
Construction and Operation of a Cyclotron to Produce One Million Volt Deuterons . . . P. GERALD KRUGER AND G. K. GREEN 699
Collisions of Neutron and Proton. II. . . . PHILIP M. MORSE, J. B. FISK AND L. I. SCHIFF 706
Distribution in Time of Counts Due to a Constant Source and Its Daughter in Equilibrium . . . LEE DEVOL AND ARTHUR RUARK 710
Shape of the Beta-Ray Distribution Curve of Radium E at High Energies . . . LAWRENCE M. LANGER AND MARTIN D. WHITAKER 713
Effect of Galactic Rotation Upon the Intensity of Cosmic Radiation . . W. F. G. SWANN 718
Auger Effect in Germanium . . . MICHAEL FERENCE, JR. 720
Spectra of Phosphorus. Part II: The Spectra of Doubly, Triply and Quadruply Ionized Phosphorus (P III, P IV, P V). Additions and Corrections to P II . HOWARD A. ROBINSON 726
Correction of Continuous Spectra for the Finite Resolution of the Spectrometer . CARL ECKART 735
Pressure Effect in Bands of Several Dipole Molecules . . . S. D. CORNELL 739
Drift of Ions and Electrons in a Magnetic Field . . . LEWI TONKS 744
Long Range Interactions Between Dipole Molecules . . . HENRY MARGENAU AND DANA T. WARREN 748
Vapor Pressure of Caesium by the Positive Ion Method . . . JOHN BRADSHAW TAYLOR AND IRVING LANGMUIR 753
Electronic Energy Bands in Metallic Calcium . . . MILLARD F. MANNING AND HARRY M. KRUTTER 761
On the Choice of the Action Function in the New Field Theory . B. HOFFMANN AND L. INFELD 765

Letters to the Editor:

Magnetic Anisotropy of Four-Coordinated CO^{++} Ions in Crystals . . . K. S. KRISHNAN AND ASUTOSH MOOKHERJI 774
Width of Iodine Resonance Neutron Band . . . SAMUEL RUBEN AND W. F. LIBBY 774
Scattering of Neutrons by Ortho- and Parahydrogen . . . JULIAN SCHWINGER AND E. TELLER 775
Proton-Induced Radioactivity in Heavy Nuclei . . . S. W. BARNES, L. A. DUBRIDGE, E. O. WIIG, J. H. BUCK AND C. V. STRAIN 775
Photoelectric Investigation of the "Allison Magneto-Optic Effect" . . . GEORGE C. COMSTOCK 776
On the Saturation Property of Nuclear Forces . . . EUGENE FEENBERG 777
Paramagnetism at Radiofrequencies . . . C. J. GORTER 778
Approximately Relativistic Equations for Nuclear Particles. Addendum. Proof of Approximate Invariance . . . G. BREIT 778
Note on the Reaction of Deuterium on Deuterium . . . M. H. JOHNSON, JR. 779
Erratum: Heights of Reflection of Radio Waves in the Ionosphere . . . F. H. MURRAY 779
Isotope Shifts in Li I . . . DOMINIC D'EUSTACHIO 780
Remanence in Single Crystals . . . K. J. SIXTUS 780
Remarks on the Paper by E. B. Baker and H. A. Boltz, "Thermionic Emission into Dielectric Liquids" . . . KARL HANS REISS 781
Superconductivity . . . KURT MENDELSSOHN 781
Production of X-Rays by High Speed Argon Ions . . . M. TANAKA AND I. NONAKA 781

MAY 15, 1937

Inelastic Collision of Deuteron and Deuteron . . . L. I. SCHIFF 783
On the Nuclear Two-, Three- and Four-Body Problems . . . WILLIAM RARITA AND R. D. PRESENT 788
On the Density of Energy Levels of Heavy Nuclei . . . JOHN BARDEEN 799
Regularity Along a Series in the Variation of the Action Cross Section with Energy Discrepancy in Impacts of the Second Kind . . . O. S. DUFFENDACK AND W. H. GRAN 804
Investigation of the Deuteron-Deuteron Reaction . . . RICHARD B. ROBERTS 810
Wilson Cloud Chamber Investigation of the Alpha-Particles from Uranium . . . W. M. RAYTON AND T. R. WILKINS 818
Ranges and Straggling Coefficients of Alpha-Particles . . ALLEN KING AND W. M. RAYTON 826
X-Ray Emission Spectra of Sulphides and Sulphates . . . JOSEPH VALASEK 832
Excitation of Characteristic X-Rays by Protons . . . M. STANLEY LIVINGSTON, FRANK GENEVESE AND E. J. KONOPINSKI 835

APRIL 1, 1937

Perturbation Theory of Light Nuclei: He^4 and Li^6 . . . D. R. INGLIS 531
On the Magnetic Scattering of Neutrons . . . J. S. SCHWINGER 544
Photoelectric Cross Section of the Deuteron . . . KATHARINE WAY 552
Unidirectional Measurements of the Cosmic-Ray Latitude Effect . . . THOMAS H. JOHNSON AND DONALD N. READ 557
Effects of Certain Liquids on the OH Vibrational Band of Alcohol . . . WALTER GORDY 564
Displacement of Principal Series Lines of Rubidium by the Addition of Rare Gases . . . NY TSI-ZÉ AND CH'EN SHANG-YI 567
Temperature Shift of the Potassium Resonance Lines . . . GORDON F. HULL, JR. 572
On the Behavior of a Certain Supraconducting Circuit . . . RICHARD J. DUFFIN 575
Note on the Hartree and Hartree-Fock Methods . . . N. H. FRANK 577
Note on the Search for Element 87 . . . F. R. HIRSH, JR. 584
Note on the Density of Eigenfunctions for an Electron Obeying Dirac's Equation . . . E. K. BROCH 586
Erratum: The Precise Measurement of Three Radium B Beta-Particle Energies . . . F. T. ROGERS, JR. 588

Letters to the Editor:

Concerning the Probable Magnitude of the Next Sunspot Maximum . . . A. L. DURKEE 589
Correction Due to Motion of Center of Gravity in the Hartree Approximation in Nuclei . . . A. F. STEVENSON 590
Inelastic Scattering of Fast Neutrons . . . D. C. GRAHAME, G. T. SEABORG AND G. E. GIBSON 590
Potential and Luminescence Insulated Willemite of Cathode-Ray Screens . . . W. B. NOTTINGHAM 591
Application of the Theory of Neutron Absorption in Aqueous Solutions . . . W. H. FURRY 592
Theory of Elasticity . . . F. D. MURNAGHAN 593
Disintegration of Li^8 . . . G. BREIT AND E. WIGNER 593
Common Ion Effect in Some Aqueous Solutions as Shown by Means of the Raman Effect . . . JAMES H. HIBBEN 593

Proceedings of the American Physical Society:

NEW ENGLAND SECTION, Cambridge Meeting, February 6, 1937; Minutes and Abstracts 1–12 594
METROPOLITAN SECTION, March 12, 1937 . . . 596

APRIL 15, 1937

On the Structure of Light Nuclei . . . E. FEENBERG AND M. PHILLIPS 597
Disintegration of Cadmium with Deuterons . . . J. M. CORK AND R. L. THORNTON 608
Relations Between the Second and Higher Order Processes in the Neutrino-Electron Field Theory . . . M. H. JOHNSON, JR. AND H. PRIMAKOFF 612
Transmutation Functions at High Bombarding Energies . . . HENRY W. NEWSON 620
Radioactivity Induced in Silicon and Phosphorus by Deuteron Bombardment . . . HENRY W. NEWSON 624
Secondary Particles from the Penetrating Component of the Cosmic Radiation . . . WILLIAM H. PICKERING 628
Structure of the X-Ray *K* Absorption Limits of Bromine, Iodine, and Some of Their Compounds . . . BERNARD CIOFFARI 630
X-Ray Fluorescence Yields . . . R. J. STEPHENSON 637
Energy Distribution of Photoelectrons Emitted by Calcium and Calcium Oxide . . . ISRAEL LIBEN 642
On Nonadiabatic Processes in Inhomogeneous Fields . . . JULIAN SCHWINGER 648
Space Quantization in a Gyrating Magnetic Field . . . I. I. RABI 652
Helium Wave Equation . . . T. H. GRONWALL 655
Helium Wave Equation . . . J. H. BARTLETT, JR. 661
On the Connection Formulas and the Solutions of the Wave Equation . . . RUDOLPH E. LANGER 669

Letters to the Editor:

Note on the Mathematical Foundation of the Thermodynamical Equation of State . . . WITOLD JACYNA 677
On the Nuclear Transformation with the Absorption of the Orbital Electron . . . HIDEKI YUKAWA AND SHOICHI SAKATA 677
On the Nature of the Superconducting State . . . F. LONDON 678
On the Probability of Detecting Nebulae Which Act as Gravitational Lenses . . . F. ZWICKY 679
Electric Breakdown Field Intensity of Water and Aqueous Solutions . . . Y. TORIYAMA AND U. SHINOHARA 680

Proceedings of the American Physical Society:

NORTH CAROLINA MEETING, February 19–20, 1937; Minutes and Abstracts 1–47; Author Index 681

MAY 1, 1937

Gamma-Rays from Light Elements Due to Proton Bombardment . . . . . R. G. HERB, D. W. KERST AND J. L. MCKIBBEN 691
Construction and Operation of a Cyclotron to Produce One Million Volt Deuterons . . . . . P. GERALD KRUGER AND G. K. GREEN 699
Collisions of Neutron and Proton. II. . . PHILIP M. MORSE, J. B. FISK AND L. I. SCHIFF 706
Distribution in Time of Counts Due to a Constant Source and Its Daughter in Equilibrium . . . . . LEE DEVOL AND ARTHUR RUARK 710
Shape of the Beta-Ray Distribution Curve of Radium E at High Energies . . . . . LAWRENCE M. LANGER AND MARTIN D. WHITAKER 713
Effect of Galactic Rotation Upon the Intensity of Cosmic Radiation . . W. F. G. SWANN 718
Auger Effect in Germanium . . . . . MICHAEL FERENCE, JR. 720
Spectra of Phosphorus. Part II: The Spectra of Doubly, Triply and Quadruply Ionized Phosphorus (P III, P IV, P V). Additions and Corrections to P II . HOWARD A. ROBINSON 726
Correction of Continuous Spectra for the Finite Resolution of the Spectrometer . CARL ECKART 735
Pressure Effect in Bands of Several Dipole Molecules . . . . . S. D. CORNELL 739
Drift of Ions and Electrons in a Magnetic Field . . . . . LEWI TONKS 744
Long Range Interactions Between Dipole Molecules . . . . . HENRY MARGENAU AND DANA T. WARREN 748
Vapor Pressure of Caesium by the Positive Ion Method . . . . . JOHN BRADSHAW TAYLOR AND IRVING LANGMUIR 753
Electronic Energy Bands in Metallic Calcium . . . . . MILLARD F. MANNING AND HARRY M. KRUTTER 761
On the Choice of the Action Function in the New Field Theory . B. HOFFMANN AND L. INFELD 765

Letters to the Editor:

Magnetic Anisotropy of Four-Coordinated CO^{++} Ions in Crystals . . . . . K. S. KRISHNAN AND ASUTOSH MOOKHERJI 774
Width of Iodine Resonance Neutron Band . . . . . SAMUEL RUBEN AND W. F. LIBBY 774
Scattering of Neutrons by Ortho- and Parahydrogen . . . JULIAN SCHWINGER AND E. TELLER 775
Proton-Induced Radioactivity in Heavy Nuclei . . . . . S. W. BARNES, L. A. DUBRIDGE, E. O. WIIG, J. H. BUCK AND C. V. STRAIN 775
Photoelectric Investigation of the "Allison Magneto-Optic Effect" . . . GEORGE C. COMSTOCK 776
On the Saturation Property of Nuclear Forces . . . . . EUGENE FEENBERG 777
Paramagnetism at Radiofrequencies . . . . . C. J. GORTER 778
Approximately Relativistic Equations for Nuclear Particles. Addendum. Proof of Approximate Invariance . . . . . G. BREIT 778
Note on the Reaction of Deuterium on Deuterium . . . . . M. H. JOHNSON, JR. 779
Erratum: Heights of Reflection of Radio Waves in the Ionosphere . . . . . F. H. MURRAY 779
Isotope Shifts in Li I . . . . . DOMINIC D'EUSTACHIO 780
Remanence in Single Crystals . . . . . K. J. SIXTUS 780
Remarks on the Paper by E. B. Baker and H. A. Boltz, "Thermionic Emission into Dielectric Liquids" . . . . . KARL HANS REISS 781
Superconductivity . . . . . KURT MENDELSSOHN 781
Production of X-Rays by High Speed Argon Ions . . . . . M. TANAKA AND I. NONAKA 781

MAY 15, 1937

Inelastic Collision of Deuteron and Deuteron . . . . . L. I. SCHIFF 783
On the Nuclear Two-, Three- and Four-Body Problems . . . . . WILLIAM RARITA AND R. D. PRESENT 788
On the Density of Energy Levels of Heavy Nuclei . . . . . JOHN BARDEEN 799
Regularity Along a Series in the Variation of the Action Cross Section with Energy Discrepancy in Impacts of the Second Kind . . . . . O. S. DUFFENDACK AND W. H. GRAN 804
Investigation of the Deuteron-Deuteron Reaction . . . . . RICHARD B. ROBERTS 810
Wilson Cloud Chamber Investigation of the Alpha-Particles from Uranium . . . . . W. M. RAYTON AND T. R. WILKINS 818
Ranges and Straggling Coefficients of Alpha-Particles . . ALLEN KING AND W. M. RAYTON 826
X-Ray Emission Spectra of Sulphides and Sulphates . . . . . JOSEPH VALASEK 832
Excitation of Characteristic X-Rays by Protons . . . . . M. STANLEY LIVINGSTON, FRANK GENEVESE AND E. J. KONOPINSKI 835

Damped Electron Waves in Crystals . . . . . J. C. SLATER 840
Wave Functions in a Periodic Potential . . . . . J. C. SLATER 846
New Method for the Measurement of the Bohr Magneton . . . . . OTTO STERN 852
On the Convergence of the Hylleraas Variational Method . . . . . ALBERT SPRAGUE COOLIDGE AND HUBERT M. JAMES 855
Criteria of Goodness for Approximate Wave Functions . . . . . HUBERT M. JAMES AND ALBERT SPRAGUE COOLIDGE 860
Magnetic Analysis of Evaporated Bi Deposits . . . . . C. T. LANE 863
Powder Patterns on Ferromagnetic Crystals . . . . . K. J. SIXTUS 870
Damping of Torsional Oscillations in Quartz Fibers . . . . . G. A. DOWNSBROUGH 877
Note on the Nature of Cosmic-Ray Particles . . . . . SETH H. NEDDERMEYER AND CARL D. ANDERSON 884

Letters to the Editor:

New Precision Determination of e/m for Electrons . . . . . A. E. SHAW 887
Note on the Sign of the Magnetic Moment of the K^{39} Nucleus . . . . . RUSSELL A. FISHER 887
Evidence for the Instability of He^5 . . J. H. WILLIAMS, W. G. SHEPHERD AND R. O. HAXBY 888
Neutron-Proton Interactions . . . . . JAMES H. BARTLETT, JR. 889
Radioactivity Due to Neutron Ejection Produced by Fast Neutrons . . . . . M. L. POOL, J. M. CORK AND R. L. THORNTON 890
Critical Frequencies of Low Ionosphere Layers . . . . . N. SMITH AND S. S. KIRBY 890

JUNE 1, 1937

Radioactivity Produced in Nickel by Deuteron Bombardment . . . . . R. L. THORNTON 893
Neutron Yields from Artificial Sources . . E. AMALDI, L. R. HAFSTAD AND M. A. TUVE 896
Radiation Probabilities, Auger Effect and Energy Level Widths for Au (79) . . . . . E. G. RAMBERG AND F. K. RICHTMYER 913
Satellite Structure of $L\alpha$ and $L\beta_2$ of Au (79) . . . F. K. RICHTMYER AND E. G. RAMBERG 925
On the Analysis of Molecular $^3\Pi$ States with Application to AlH, OH^+, and BH . . . . . C. N. CHALLACOMBE AND G. M. ALMY 930
Low Voltage Proton Sources . . . E. S. LAMAR, W. W. BUECHNER AND K. T. COMPTON 936
On the Matrix Element in Fermi's Theory of β-Decay . . L. W. NORDHEIM AND F. L. YOST 942
On the Structure of Nuclei Beyond Oxygen . . . . . E. WIGNER 947
Geiger-Müller Counter Measurements of Reflected Mo Kα X-Rays from Powdered Zinc . . . . . R. D. MILLER 959
Built-Up Films of Barium Stearate and Their Optical Properties . . . . . KATHARINE B. BLODGETT AND IRVING LANGMUIR 964
Properties of the Surface Magnetization in Ferromagnetic Crystals . . . W. C. ELMORE 982

Letters to the Editor:

Thermonic Emission into Dielectric Liquids . . . EDWARD B. BAKER AND HOWARD A. BOLTZ 989
Structure of Hα of Hydrogen . NORTON A. KENT, ROYAL A. FRYE AND WILLIAM H. ROBINSON 990
Velocity of Radio Waves Over Long Distances . . . . . R. C. COLWELL AND A. W. FRIEND 990
Additional Interaction of Protons with an Electromagnetic Field, Due to the Presence of the Electron-Neutrino Field . . . . . H. PRIMAKOFF 990
On the Theory of Neutron Scattering by Magnetic Substances . . . . . O. HALPERN AND M. H. JOHNSON, JR. 992
Ionosphere and Magnetic Storms . S. S. KIRBY, N. SMITH, T. R. GILLILAND AND S. E. REYMER 992
Interferometer Measurements of Wave-Lengths in H_2 Bands . . H. LANDAHL AND G. S. MONK 993
Erratum: Nuclear Spins and Magnetic Moments in the Hartree Model . . . . . M. E. ROSE AND H. A. BETHE 993
On the Magnetic Scattering of Neutrons. II . . . . . F. BLOCH 994
Proton Induced Radioactivity in Oxygen . . L. A. DUBRIDGE, S. W. BARNES AND J. H. BUCK 995
Scattering of Fast Neutrons . . . . . C. H. FAY 995
Long Period Activity in Cadmium Irradiated with Neutrons . . . . ALLAN C. G. MITCHELL 995
On Hard Gamma-Rays from Ra (C+C'+C''+D) . . . . . SOTOHIKO NISHIDA 996

Proceedings of the American Physical Society:

WASHINGTON MEETING, April 29–May 1, 1937, Minutes and Abstracts 1–161; Author Index 997–1031

JUNE 15, 1937

Induced Radioactivity of Potassium. . . . . D. G. HURST AND H. WALKE 1033
Disintegration of High Energy Protons. . . . . G. NORDHEIM, L. W. NORDHEIM, J. R. OPPENHEIMER AND R. SERBER 1037
Heavy Particle Interactions from β-Decay Theory. . . . . GLEN D. CAMP 1046
Signs of the Nuclear Magnetic Moments of Li^7, Rb^{85}, Rb^{87} and Cs^{133}. . . . . S. MILLMAN AND J. R. ZACHARIAS 1049
Radioactive Isotope of Rubidium. . . . . A. HEMMENDINGER AND W. R. SMYTHE 1052
Effect of Temperature on the Intensity of Reflection of X-Rays from Zinc Crystals. . . . . E. O. WOLLAN AND G. G. HARVEY 1054
Atomic Structure and Vibrations in Zinc Crystals. IV. Diffuse Scattering of X-Rays at Different Temperatures. . . . . G. E. M. JAUNCEY AND W. A. BRUCE 1062
Atomic Structure and Vibrations in Zinc Crystals. V. The Diffuse Scattering of X-Rays at Various Scattering Angles. . . . . W. A. BRUCE AND E. M. MCNATT 1065
Atomic Structure and Vibrations in Zinc Crystals. VI. Determination of Electron Asymmetry and Two Principal Characteristic Temperatures . G. E. M. JAUNCEY AND W. A. BRUCE 1067
Rotation of Water Molecules in Carbon Disulfide Solution. . E. L. KINSEY AND J. W. ELLIS 1074
Structure of the α and β Band Systems of SiF . . . . . EUGENE H. EYSTER 1078
Spectra of K III, Ca IV, and Sc V, and their Relation to the Spectra of Other Ions in the Isoelectronic Sequence Cl I to Mn IX. . . . . P. GERALD KRUGER AND L. W. PHILLIPS 1087
Spectra of Sc IV, Ti V, Mn VIII and Fe IX in the Isoelectronic Sequence A I to Fe IX. . . . . P. GERALD KRUGER, S. G. WEISSBERG AND L. W. PHILLIPS 1090
Rankine Magnetic Balance and the Magnetic Susceptibility of H_2O, HDO and D_2O. . . . . HAIG P. ISKENDERIAN 1092
Piezodielectric Effect and Electrostriction in Anisotropic or Isotropic Media . . . . . HAROLD OSTERBERG AND JOHN W. COOKSON 1096

Letters to the Editor:

Artificial Radioactivity Produced by Alpha-Particles . LOUIS N. RIDENOUR AND W. J. HENDERSON 1102
Radioactivity Alpha-Particles from Li^7+H^2 . . . . . W. A. FOWLER AND C. C. LAURITSEN 1103
On the Origin of Cosmic Rays . . . . . A. H. COMPTON AND P. Y. CHOU 1104
Determination of the Shower Producing Efficiency of Cosmic-Ray Particles . . . . . W. E. RAMSEY AND W. E. DANFORTH 1105
Neutron Refraction . . . . . GILBERT N. LEWIS AND PHILIP W. SCHUTZ 1105
Conservation of Energy in the Disintegration of Li^8 . . . . . L. H. RUMBAUGH, R. B. ROBERTS AND L. R. HAFSTAD 1106
Radioactivity of K^{38} . W. J. HENDERSON, L. N. RIDENOUR, M. G. WHITE AND M. C. HENDERSON 1107
Decrease in the Electrical Resistance of Gold With a Magnetic Field at Low Temperatures. . . . . W. F. GIAUQUE, J. W. STOUT AND C. W. CLARK 1108
Connection Between the Second Virial Coefficient and the Phases of Collision Theory . . . . . LEON GROPPER 1108
On the Effects in Cosmic-Ray Intensity Observed During the Recent Magnetic Storm . . . . . S. E. FORBUSH 1108
On the Absorption of Cosmic-Ray Electrons in the Atmosphere. . . . . L. W. NORDHEIM 1110
Theory of Recombination of Ions Over an Extended Pressure Range. . . . . LEONARD B. LOEB 1110
Thin Film Field Emission . . . . . E. R. PIORE 1111
Experiments on the Magnetic Moment of the Neutron. . . . . P. N. POWERS, H. CARROLL AND J. R. DUNNING 1112
Note on the Nature of Cosmic-Ray Particles . . . . . J. R. OPPENHEIMER AND R. SERBER 1113

Author Index to Volume 51 1114
Analytic Subject Index to Volume 51 1128

Damped Electron Waves in Crystals . . . . . J. C. SLATER 840
Wave Functions in a Periodic Potential . . . . . J. C. SLATER 846
New Method for the Measurement of the Bohr Magneton . . . . . OTTO STERN 852
On the Convergence of the Hylleraas Variational Method . . . . . ALBERT SPRAGUE COOLIDGE AND HUBERT M. JAMES 855
Criteria of Goodness for Approximate Wave Functions . . . . . HUBERT M. JAMES AND ALBERT SPRAGUE COOLIDGE 860
Magnetic Analysis of Evaporated Bi Deposits . . . . . C. T. LANE 863
Powder Patterns on Ferromagnetic Crystals . . . . . K. J. SIXTUS 870
Damping of Torsional Oscillations in Quartz Fibers . . . . . G. A. DOWNSBROUGH 877
Note on the Nature of Cosmic-Ray Particles . . . . . SETH H. NEDDERMEYER AND CARL D. ANDERSON 884

Letters to the Editor:

New Precision Determination of e/m for Electrons . . . . . A. E. SHAW 887
Note on the Sign of the Magnetic Moment of the K^{39} Nucleus . . . . . RUSSELL A. FISHER 887
Evidence for the Instability of He^5 . . J. H. WILLIAMS, W. G. SHEPHERD AND R. O. HAXBY 888
Neutron-Proton Interactions . . . . . JAMES H. BARTLETT, JR. 889
Radioactivity Due to Neutron Ejection Produced by Fast Neutrons . . . . . M. L. POOL, J. M. CORK AND R. L. THORNTON 890
Critical Frequencies of Low Ionosphere Layers . . . . . N. SMITH AND S. S. KIRBY 890

JUNE 1, 1937

Radioactivity Produced in Nickel by Deuteron Bombardment . . . . . R. L. THORNTON 893
Neutron Yields from Artificial Sources . . E. AMALDI, L. R. HAFSTAD AND M. A. TUVE 896
Radiation Probabilities, Auger Effect and Energy Level Widths for Au (79) . . . . . E. G. RAMBERG AND F. K. RICHTMYER 913
Satellite Structure of $L\alpha$ and $L\beta_2$ of Au (79) . . . F. K. RICHTMYER AND E. G. RAMBERG 925
On the Analysis of Molecular $^3\Pi$ States with Application to AlH, OH^+, and BH . . . . . C. N. CHALLACOMBE AND G. M. ALMY 930
Low Voltage Proton Sources . . . E. S. LAMAR, W. W. BUECHNER AND K. T. COMPTON 936
On the Matrix Element in Fermi's Theory of β-Decay . . L. W. NORDHEIM AND F. L. YOST 942
On the Structure of Nuclei Beyond Oxygen . . . . . E. WIGNER 947
Geiger-Müller Counter Measurements of Reflected Mo $K\alpha$ X-Rays from Powdered Zinc . . . . . R. D. MILLER 959
Built-Up Films of Barium Stearate and Their Optical Properties . . . . . KATHARINE B. BLODGETT AND IRVING LANGMUIR 964
Properties of the Surface Magnetization in Ferromagnetic Crystals . . . W. C. ELMORE 982

Letters to the Editor:

Thermonic Emission into Dielectric Liquids . . . EDWARD B. BAKER AND HOWARD A. BOLTZ 989
Structure of $H\alpha$ of Hydrogen . NORTON A. KENT, ROYAL A. FRYE AND WILLIAM H. ROBINSON 990
Velocity of Radio Waves Over Long Distances . . . . . R. C. COLWELL AND A. W. FRIEND 990
Additional Interaction of Protons with an Electromagnetic Field, Due to the Presence of the Electron-Neutrino Field . . . . . H. PRIMAKOFF 990
On the Theory of Neutron Scattering by Magnetic Substances . . . . . O. HALPERN AND M. H. JOHNSON, JR. 992
Ionosphere and Magnetic Storms . S. S. KIRBY, N. SMITH, T. R. GILLILAND AND S. E. REYMER 992
Interferometer Measurements of Wave-Lengths in H_2 Bands . . H. LANDAHL AND G. S. MONK 993
Erratum: Nuclear Spins and Magnetic Moments in the Hartree Model . . . . . M. E. ROSE AND H. A. BETHE 993
On the Magnetic Scattering of Neutrons. II . . . . . F. BLOCH 994
Proton Induced Radioactivity in Oxygen . . L. A. DUBRIDGE, S. W. BARNES AND J. H. BUCK 995
Scattering of Fast Neutrons . . . . . C. H. FAY 995
Long Period Activity in Cadmium Irradiated with Neutrons . . . . ALLAN C. G. MITCHELL 995
On Hard Gamma-Rays from Ra (C+C′+C″+D) . . . . . SOTOHIKO NISHIDA 996

Proceedings of the American Physical Society:

WASHINGTON MEETING, April 29–May 1, 1937, Minutes and Abstracts 1–161; Author Index 997–1031

JUNE 15, 1937

Induced Radioactivity of Potassium. . . . . D. G. HURST AND H. WALKE 1033
Disintegration of High Energy Protons. . . . . G. NORDHEIM, L. W. NORDHEIM, J. R. OPPENHEIMER AND R. SERBER 1037
Heavy Particle Interactions from β-Decay Theory. . . . . GLEN D. CAMP 1046
Signs of the Nuclear Magnetic Moments of Li^7, Rb^{85}, Rb^{87} and Cs^{133}. . . . . S. MILLMAN AND J. R. ZACHARIAS 1049
Radioactive Isotope of Rubidium. . . . . A. HEMMENDINGER AND W. R. SMYTHE 1052
Effect of Temperature on the Intensity of Reflection of X-Rays from Zinc Crystals. . . . . E. O. WOLLAN AND G. G. HARVEY 1054
Atomic Structure and Vibrations in Zinc Crystals. IV. Diffuse Scattering of X-Rays at Different Temperatures. . . . . G. E. M. JAUNCEY AND W. A. BRUCE 1062
Atomic Structure and Vibrations in Zinc Crystals. V. The Diffuse Scattering of X-Rays at Various Scattering Angles. . . . . W. A. BRUCE AND E. M. MCNATT 1065
Atomic Structure and Vibrations in Zinc Crystals. VI. Determination of Electron Asymmetry and Two Principal Characteristic Temperatures . G. E. M. JAUNCEY AND W. A. BRUCE 1067
Rotation of Water Molecules in Carbon Disulfide Solution. . E. L. KINSEY AND J. W. ELLIS 1074
Structure of the α and β Band Systems of SiF . . . . . EUGENE H. EYSTER 1078
Spectra of K III, Ca IV, and Sc V, and their Relation to the Spectra of Other Ions in the Isoelectronic Sequence Cl I to Mn IX. . . . . P. GERALD KRUGER AND L. W. PHILLIPS 1087
Spectra of Sc IV, Ti V, Mn VIII and Fe IX in the Isoelectronic Sequence A I to Fe IX. . . . . P. GERALD KRUGER, S. G. WEISSBERG AND L. W. PHILLIPS 1090
Rankine Magnetic Balance and the Magnetic Susceptibility of H_2O, HDO and D_2O. . . . . HAIG P. ISKENDERIAN 1092
Piezodielectric Effect and Electrostriction in Anisotropic or Isotropic Media . . . . . HAROLD OSTERBERG AND JOHN W. COOKSON 1096

Letters to the Editor:

Artificial Radioactivity Produced by Alpha-Particles . LOUIS N. RIDENOUR AND W. J. HENDERSON 1102
Radioactivity Alpha-Particles from Li^7+H^2 . . . . . W. A. FOWLER AND C. C. LAURITSEN 1103
On the Origin of Cosmic Rays . . . . . A. H. COMPTON AND P. Y. CHOU 1104
Determination of the Shower Producing Efficiency of Cosmic-Ray Particles . . . . . W. E. RAMSEY AND W. E. DANFORTH 1105
Neutron Refraction . . . . . GILBERT N. LEWIS AND PHILIP W. SCHUTZ 1105
Conservation of Energy in the Disintegration of Li^8 . . . . . L. H. RUMBAUGH, R. B. ROBERTS AND L. R. HAFSTAD 1106
Radioactivity of K^{38} . W. J. HENDERSON, L. N. RIDENOUR, M. G. WHITE AND M. C. HENDERSON 1107
Decrease in the Electrical Resistance of Gold With a Magnetic Field at Low Temperatures. . . . . W. F. GIAUQUE, J. W. STOUT AND C. W. CLARK 1108
Connection Between the Second Virial Coefficient and the Phases of Collision Theory . . . . . LEON GROPPER 1108
On the Effects in Cosmic-Ray Intensity Observed During the Recent Magnetic Storm . . . . . S. E. FORBUSH 1108
On the Absorption of Cosmic-Ray Electrons in the Atmosphere. . . . . L. W. NORDHEIM 1110
Theory of Recombination of Ions Over an Extended Pressure Range. . . . . LEONARD B. LOEB 1110
Thin Film Field Emission . . . . . E. R. PIORE 1111
Experiments on the Magnetic Moment of the Neutron. . . . . P. N. POWERS, H. CARROLL AND J. R. DUNNING 1112
Note on the Nature of Cosmic-Ray Particles . . . . . J. R. OPPENHEIMER AND R. SERBER 1113

Author Index to Volume 51 1114
Analytic Subject Index to Volume 51 1128